An Estimate of the Possible Reduction in Crashes by using ***Road-Aware***

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1. Executive Summary

The number of fatal crashes in the United States involving large trucks has been increasing annually since 2009 reach over 5,000 fatalities in 2020. Certain high-profile crashes have brought increased media attention to safety problems that plague the trucking industry. Pressure is being brought to bear to improve safety for the industry and the traveling public.

The use of ***Road-Aware*** as a driver aid will reduce crashes by 15% or more. This estimate is reached by eliminating rollover as first harmful event (5%), also eliminating collision with a fixed object as a first harmful event (8%) and reducing truck at fault collisions by 5% which gives a total reduction of 18%. This result can be cross checked by combing the observation that 30% of truck crashes occur on curves and that excess speed is a causal factor in 45% of those crashes. Finally, it can also be compared to results from the use of other systems that record driver behavior such as critical event reporting and speeding event recording. Reported reductions are 20% in the first case and 38% in the second.

If ***Road-Aware*** is used as an enabling tool to measure and manage driver performance in a comprehensive management driven safety program, crash rates can be reduced by 50% for most companies. There are trucking companies that use technology coupled with effective driver safety policies and procedures to achieve low crash rates. The top ten companies have total crash rates that are less than 30 per hundred million miles. The median for 100 companies is 53 crashes per hundred million miles. The least safe companies exceed 70 crashes per hundred million miles.

If ***Road-Aware*** is used as a tool to enable a complete top-down safety program employing the five essentials, crash rates can be improved by 50% or more. Even in a minimal safety effort, crash rates can be decreased by 15% or more using ***Road-Aware***. If all 100 companies in the sample employed safety technologies coupled with management oversight, training, and appropriate driver incentives to achieve

the same performance as the top ten companies, the number of crashes would be reduced by 56% saving an annual total of $1.3 billion for these companies collectively.

2. Estimate of Truck Crash Reductions by use of *Road-Aware*

Fatalities from crashes involving large trucks hit a low in 2008 yet have increased each year beginning in 2009, reaching 5,000 in 2019.

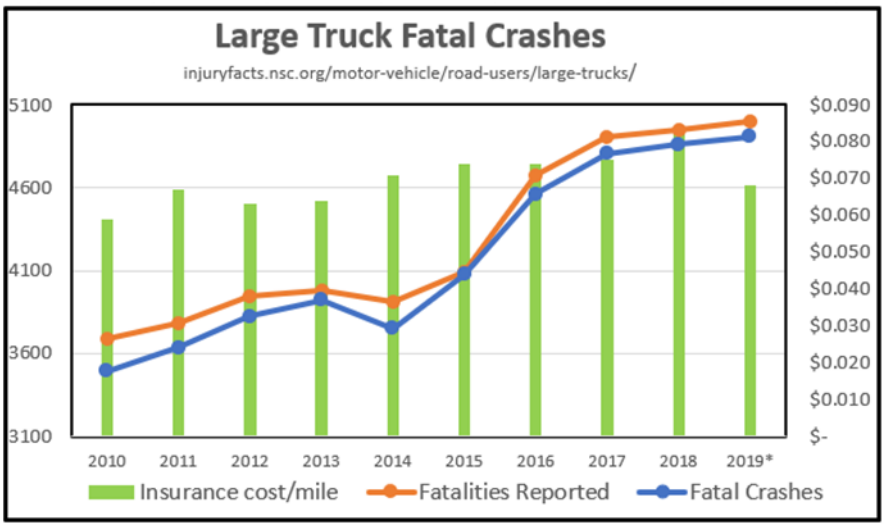

Figure 1: Fatalities from crashes involving large trucks

This chart illustrates the need to apply new solutions to reduce the number and severity of truck crashes. Strong evidence exists that certain technologies can have a dramatic effect on safety. For example, the introduction of Electronic Stability Control (ESC) which was an option on high end passenger vehicles in the late nineties is now a mandated requirement on every passenger vehicle and light duty truck in the US. Estimates suggest that this technology is saving 8,000 lives per year. Another success in trucking came in the form of critical event recording, introduced by suppliers of GPS tracking/Fleet Management systems. Reports from customers state that rear end collisions declined by substantial percentages using critical event reporting and follow up training for drivers. Now, new technology exists to prevent rollover and runaway crashes using the hardware and servers that GPS tracking companies already have in place.

The Fatal Accident Reporting System (FARS) database provided by the National Highway Transportation Safety Administration (NHTSA) was queried for crash data in which a large truck was involved for the number of crashes that occur on curves, the number of crashes that only involve a single vehicle, estimate of the number of multi-vehicle crashes where the truck driver is at fault, and the first harmful events in large truck crashes. Unfortunately, the FARS data does not have a category from which one can directly derive the number and severity of crashes that occurred because of the driver losing control of the vehicle on a curve or descent.

However, some of the key results derived from the FARS data for crashes in which a large truck is involved and reported by NHTSA and provide a basis for estimating that number are the following:

- Truck crashes that occur on a curve – 30% (derived from cross tab queries)
- Truck crashes in which only the truck is involved – i.e., single vehicle crashes – 21%
- Truck crashes in which the first harmful event is a rollover - 5% (NHTSA category)
- Truck crashes in which the first harmful event is collision with a fixed object – 8% (NHTSA category)
- NHTSA FARS data (2012): Large trucks that rolled over in fatal crashes – 14.9% national (Texas 19.7%, Colorado 23.5%)
- Multi-vehicle crashes in which the truck driver is at fault – estimated by NHTSA at 20%

In addition, the FARS data for all vehicles (cars and trucks) involved in fatal crashes show that 21.6% were negotiating a curve at the time of the crash. **These numbers suggest that a technology focused on reducing crashes while the truck is negotiating a curve, taking a ramp connecting two roadways or taking an exit could result in a significant reduction in crashes and the cost of crashes.**

A starting point for building an estimate is applying the NHTSA data stating that 30% of truck crashes occur on a curve. Other studies, McKnight and Bahouth 2007 (Analysis of Large Truck Rollover Crashes (nih.gov)) show that excessive speed is a causal factor in 45% of a sample of 239 rollover crashes in the LTCCS study sponsored by FMCSA in 2002. NHTSA categories for fist harmful event list rollover in 5% of total crashes and collision with a fixed object (implies a departure from the travel lane) as the first harmful event in 8% of total crashes. Clearly, the driver has lost control of the truck before these crashes. ***Road-Aware*** is designed to provide alerts and safe speeds to ensure that the driver retains control of the vehicle in all load conditions and road geometries. Using an appropriate safety margin (30% or higher), loss of control crashes can be all but eliminated. This would result in a 13% reduction in total crashes.

The NHTSA data also attribute 20% of multi-vehicle crashes to errors made by the truck driver. This means that another 16% (20% of 79%) of total crashes are the fault of the truck driver. Through slowing the truck down in segments of the highway with difficult centerline geometries (curves, down slopes, connector ramps, and exit ramps) the truck driver will make fewer errors and have more time to respond to errors made by drivers of other vehicles. Using the knowledge that 30% of crashes occur on curves, it is reasonable to expect that of the total truck at fault collisions (16%), 30% occur on curves. These collisions can also be mitigated by use of ***Road-Aware***. This would provide another 5% reduction in total crashes bringing the total estimate to 18%. This estimate fits within the experience cited in the use of CER to improve driver performance.

3. The Top Ten

A comparison of the safety record of commercial carriers can be created from crash reports provided by carriers to USDOT which are then reported using the SAFER System. (U.S. DoT/FMCSA/SAFER System) The chart below shows the results for a sample of 57 freight carriers and 47 bulk haulers. The number of

crashes for each company were totaled (fatal plus injury plus tow away) and then normalized against the total number of miles reported by the same company. This provided a total crash number per hundred million miles for each company. The companies were then ranked by total crash per 100Mm scores which results in the following graph.

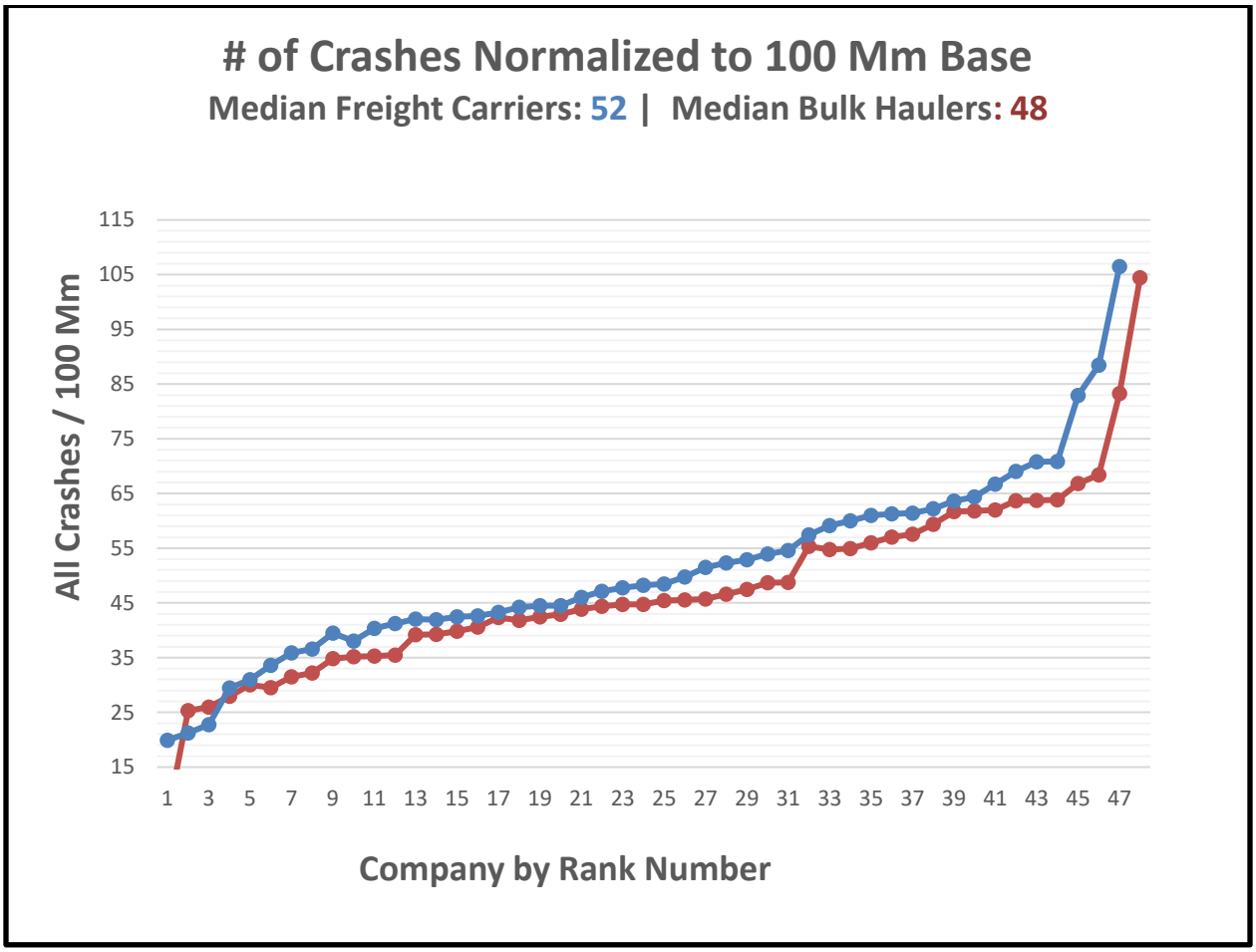

Figure 2: Comparison of Crash Rates at Trucking Companies

It is notable that the total crash rate per 100Mm is about 25 for the top ten companies (lower left). In comparison, the median performance is 52 crashes per 100Mm for freight carriers (48 for bulk haulers) and the worst five companies are 75 and above.

This is an extremely important analysis. It is immediately apparent that a huge improvement can be made in safety if all companies followed the leading companies using top-down safety leadership, applying technologies coupled with management oversight, additional training, and compensation incentives to improve safety performance. There are five essentials to make this step to higher performance.

1. Leadership from the CEO. There must be genuine buy in on the part of the CEO and he must communicate safety consistently, frequently and with emphasis.

2. Create an effective safety organization led by an SVP that reports directly to the CEO. The organization must be staffed with trained professionals in sufficient number to supervise the total compliment of drivers.
3. Measure & manage safety performance of drivers daily using performance standards set by the company that are then communicated to the drivers and measured consistently. Driver scores are provided to the driver and the supervisor. Driver scores are also posted to allow peer review.
4. Establish and operate a recurrent training program where safe driving techniques are taught. This can be on-line video training with questions at the conclusion to ensure that the trainee understands the safety objectives, systems and equipment provided by the company.
5. Excellent safety records by drivers need to be recognized and compensated.

In a recent white paper by Rebecca Kemp (White-Paper-Encourage-safe-driving-1.0.pdf (eroad.co.nz)) she noted that consistent measuring and reviews of driver behavior led to huge improvements in performance. She notes that organizations that use driver behavior analytics have 38% fewer speeding events than organizations that don't observe driver behavior. She also notes that change in driver behavior takes time, but it is highly achievable. The keys to improved driver performance are consistence application of driver behavior analytics.

Road-Aware is also a measure and manage tool for driver performance. It has the advantage that it alerts the driver and provides the driver with a recommended safe speed for the upcoming geometry (curve, connector ramp or downslope) that is specific to the truck configuration and load being carried. Thus, the speed of the truck is compared to the recommended speed for every hazardous geometry encountered on the journey. High resolution data (1 hertz) is stored on the device and automatically uploaded to the cloud at the end of the trip. A driver score is automatically calculated and delivered back to the driver. As noted in the Kemp white paper, scores can then be posted for peer review and used in calculating safety compensation incentives.

The authors calculated the number of crashes that could have been avoided if all the 100 companies in the sample achieved the same safety performance as the top ten companies. The result is an astounding 56% reduction in total crashes and an 80% reduction in fatalities and a 46% reduction in injuries. The total cost savings were calculated at $1.3 billion using ATRI average costs for crashes.

4. Conclusions

The addition of a technology focused on reducing crashes while the truck is negotiating a curve, taking a ramp connecting two roadways or taking an exit provides a management tool that properly employed with the drivers by creating incentives for good driving behavior as well as immediately following up poor behavior with interventions that include remedial training, should provide immediate benefits by substantially reducing the costs of crashes to the company. An appropriate goal for management would be to reduce the number of crashes by 20% in the first year and up to 50% in the third year.

Such technology, at the limit of use and with conservative safety margins and rigorous management, could eliminate truck driver at fault rollovers and collisions with a fixed object as well as reducing truck at fault multi-vehicle collisions on curves.